(No Model.) 3 Sheets—Sheet 1.

G. CRINER.

BOILER FURNACE.

No. 246,943. Patented Sept. 13, 1881.

FIG. 1.

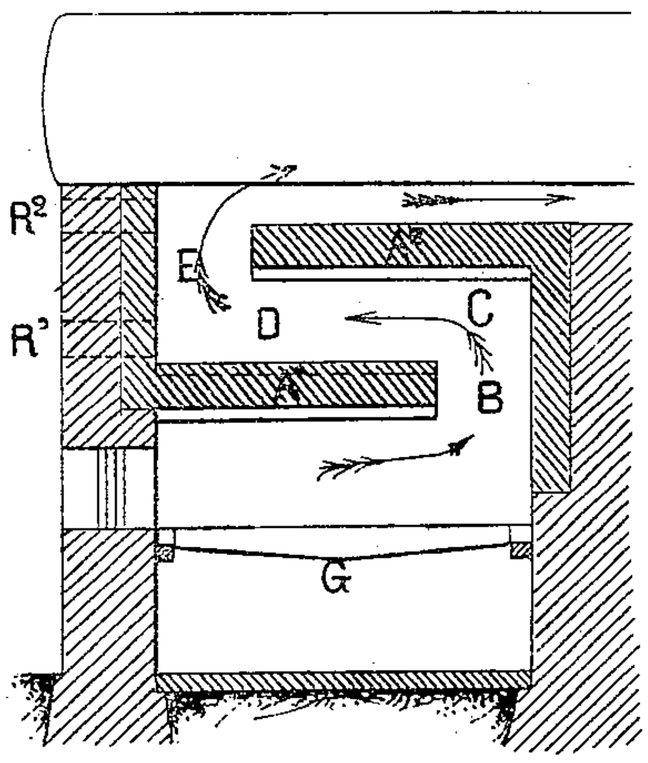


FIG 1bis

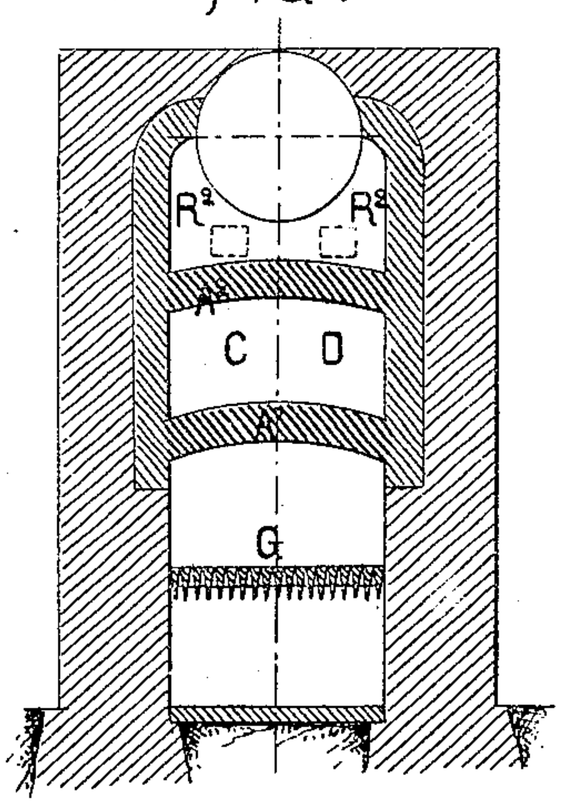


FIG. 2.

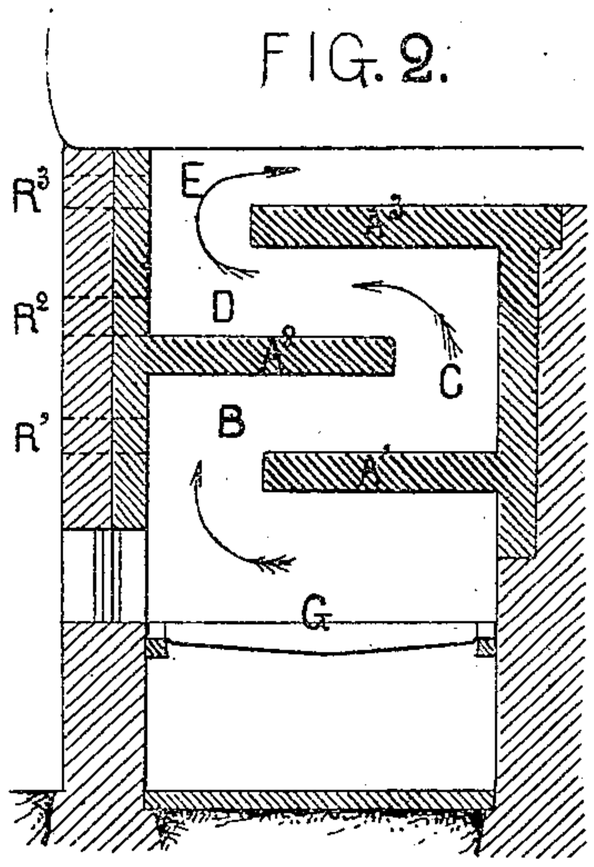


FIG. 3

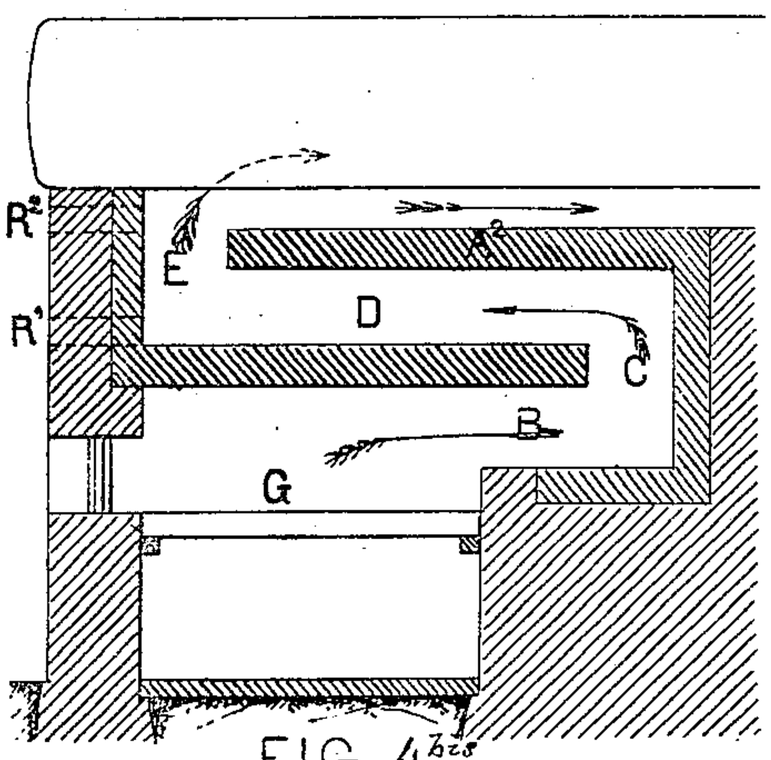


FIG. 4bis

FIG. 5.

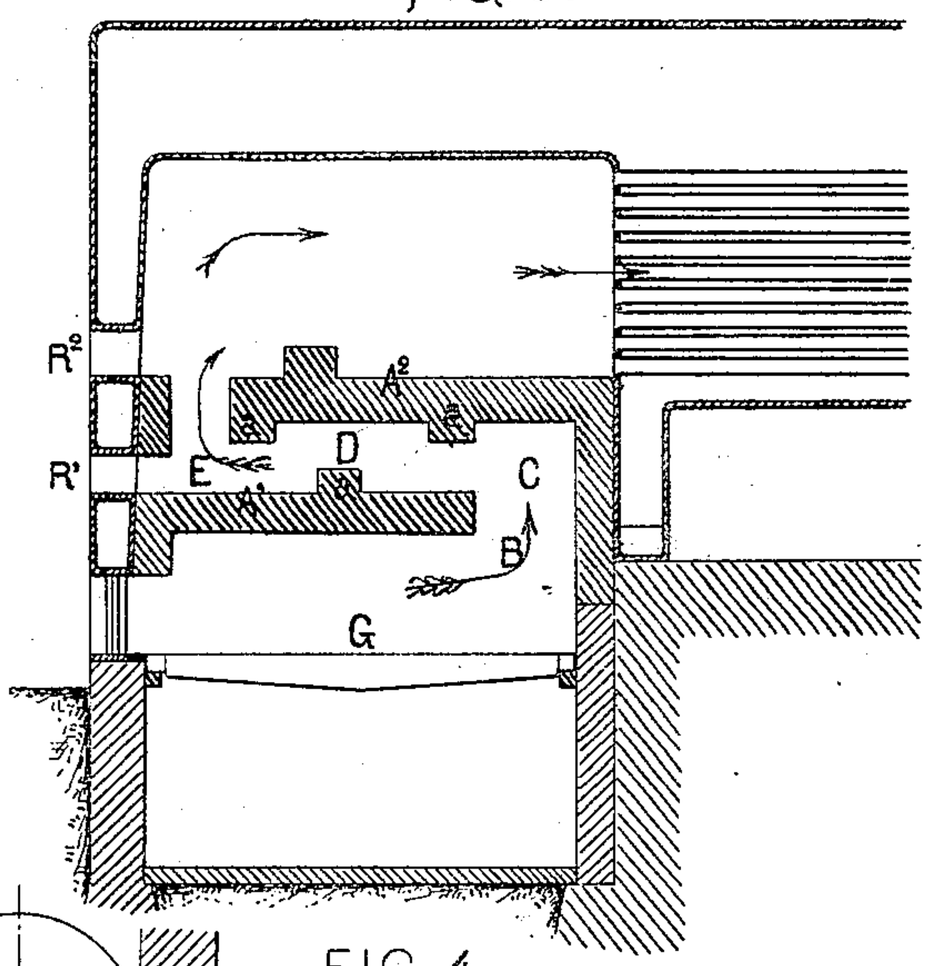
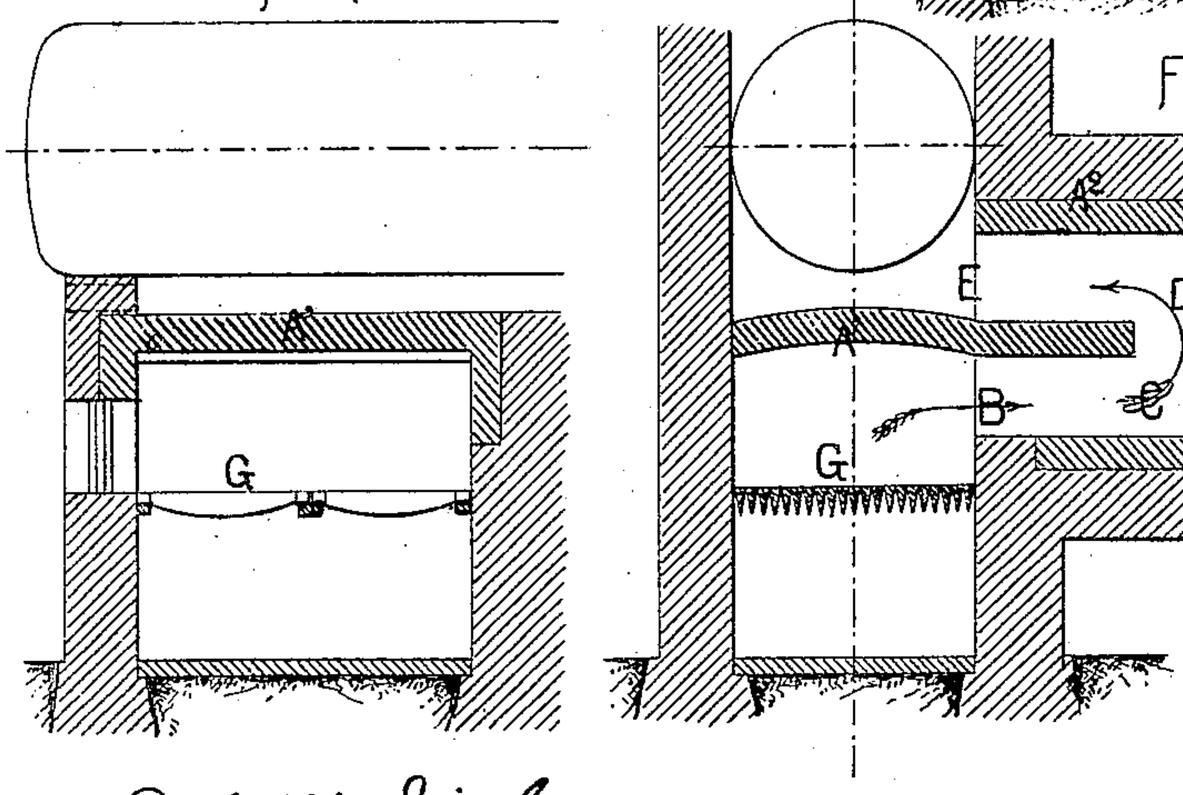


FIG. 4.



C. J. Hedrick
Philip Pellaumail
witnesses.

Georges Criner
by A. Pollok his attorney

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BOILER FURNACE.

No. 246,943. Patented Sept. 13, 1881.

FIG. 6.

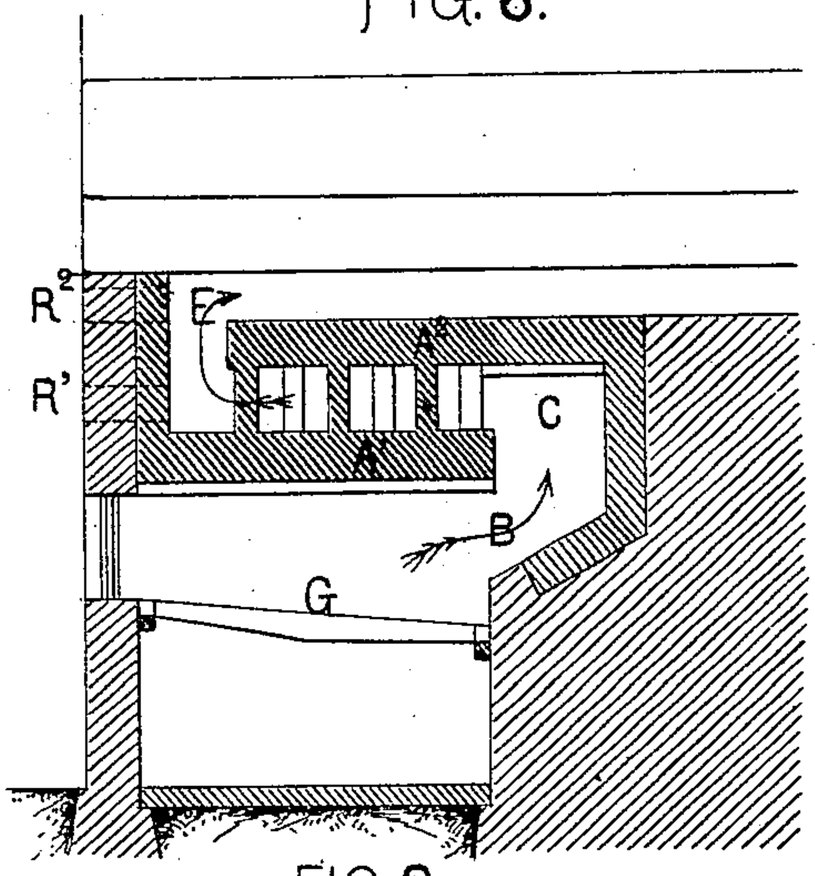


FIG. 8.

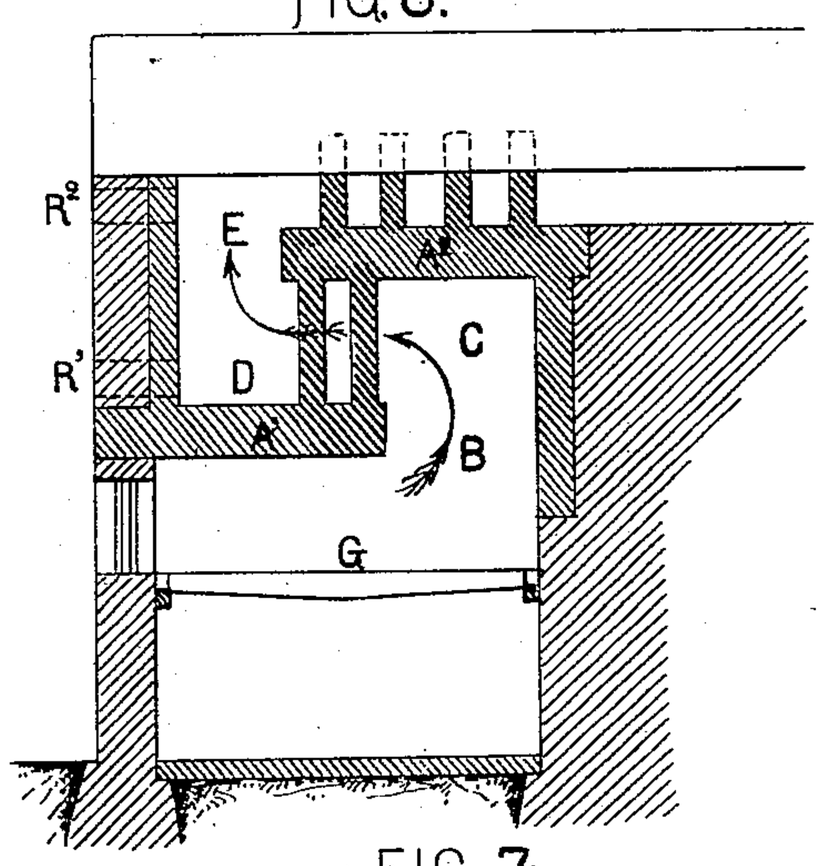


FIG. 7.

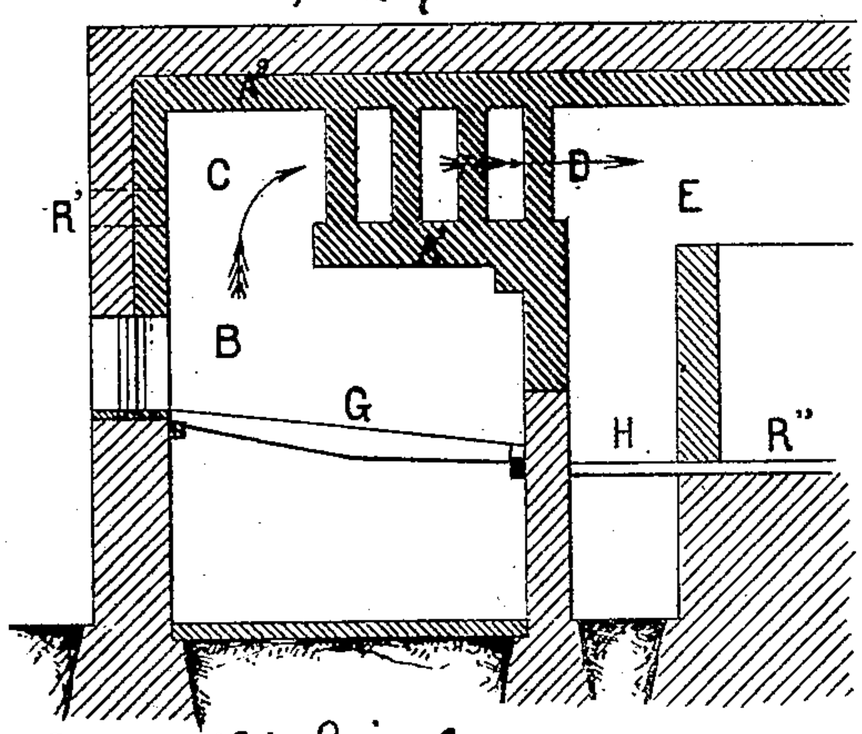


FIG. 6bis

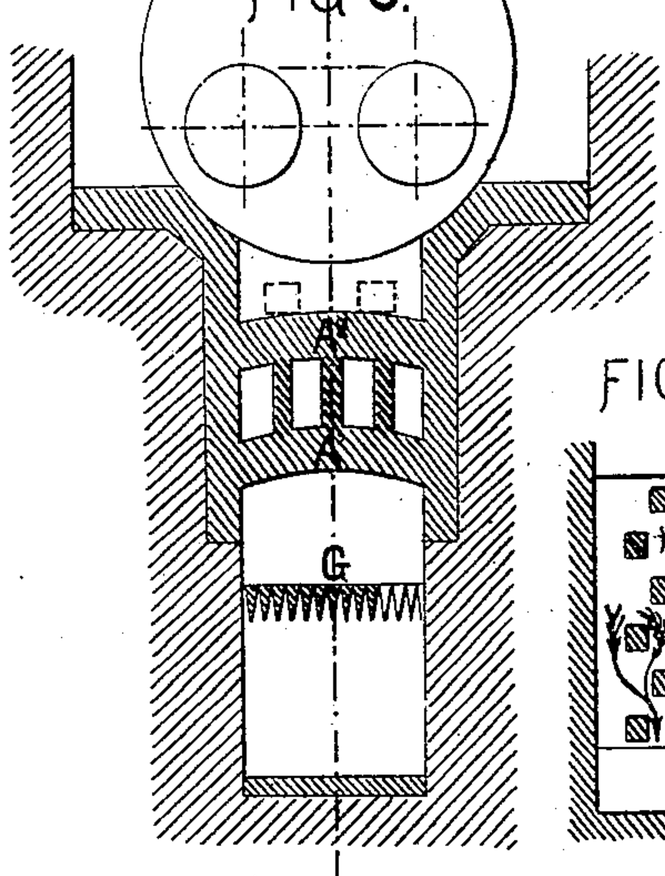


FIG. 6ter

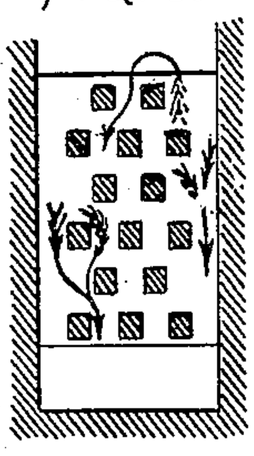


FIG. 8bis

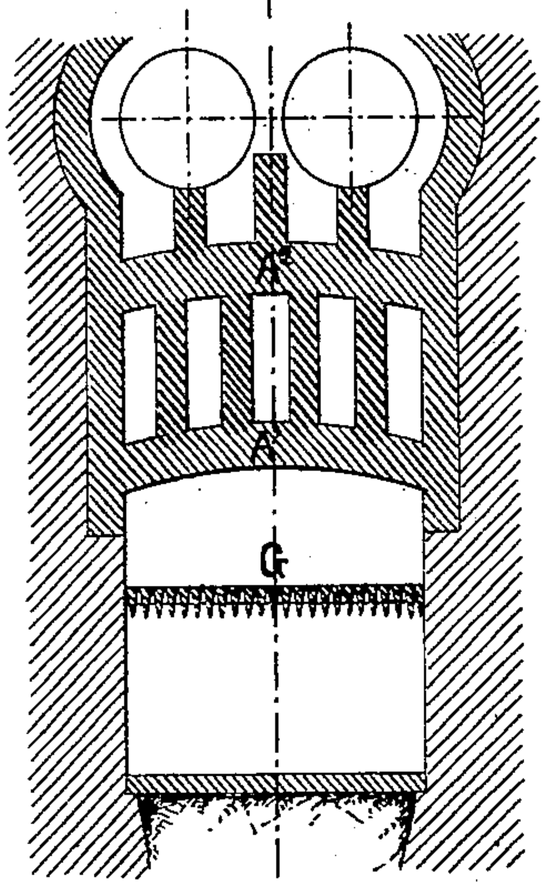
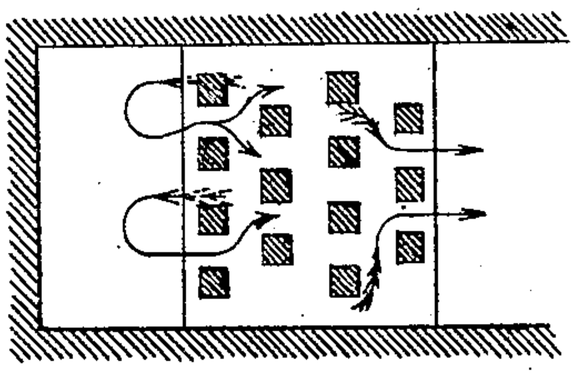


FIG. 7bis



C. J. Hedrick. Witnesses.
Philip Dellaven

Georges Criner
by A. Pollok
his attorney.

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BOILER FURNACE.

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FIG. 9.

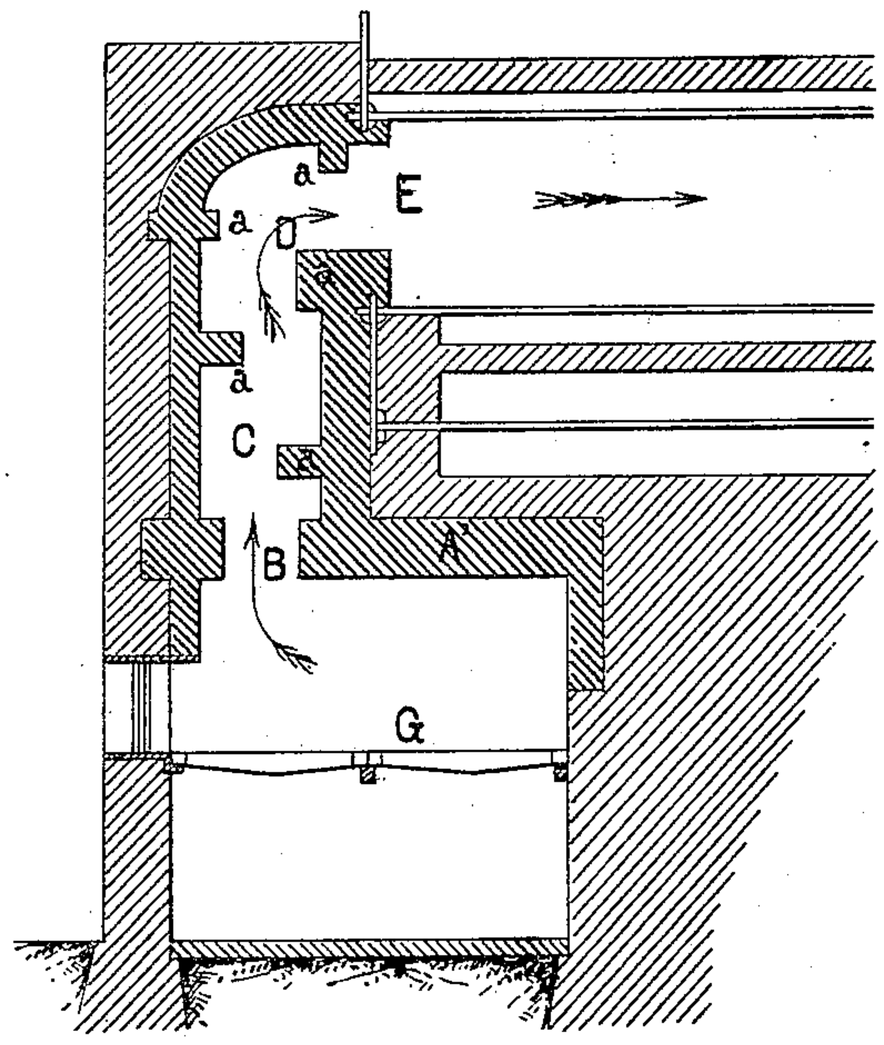


FIG. 11.

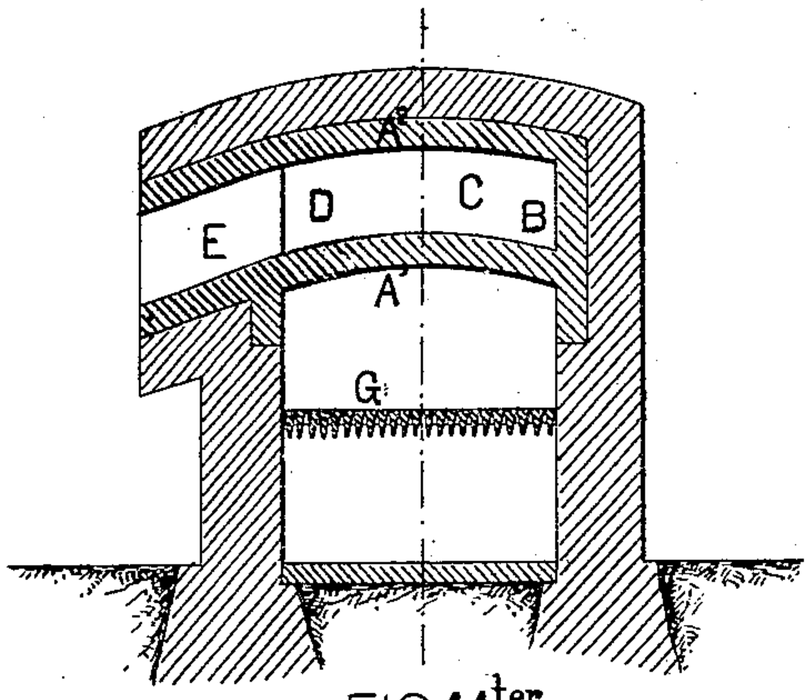


FIG. 11ter

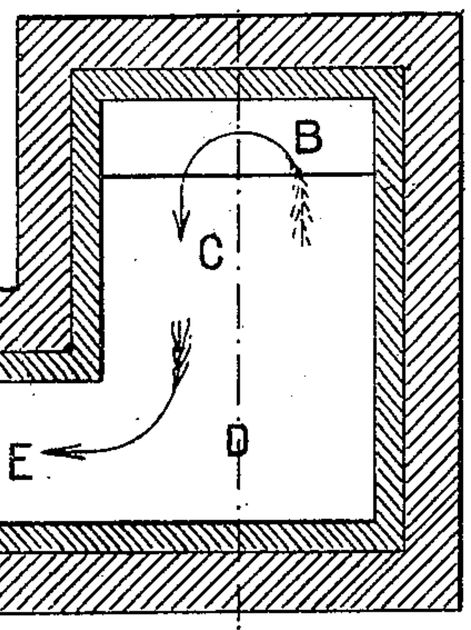
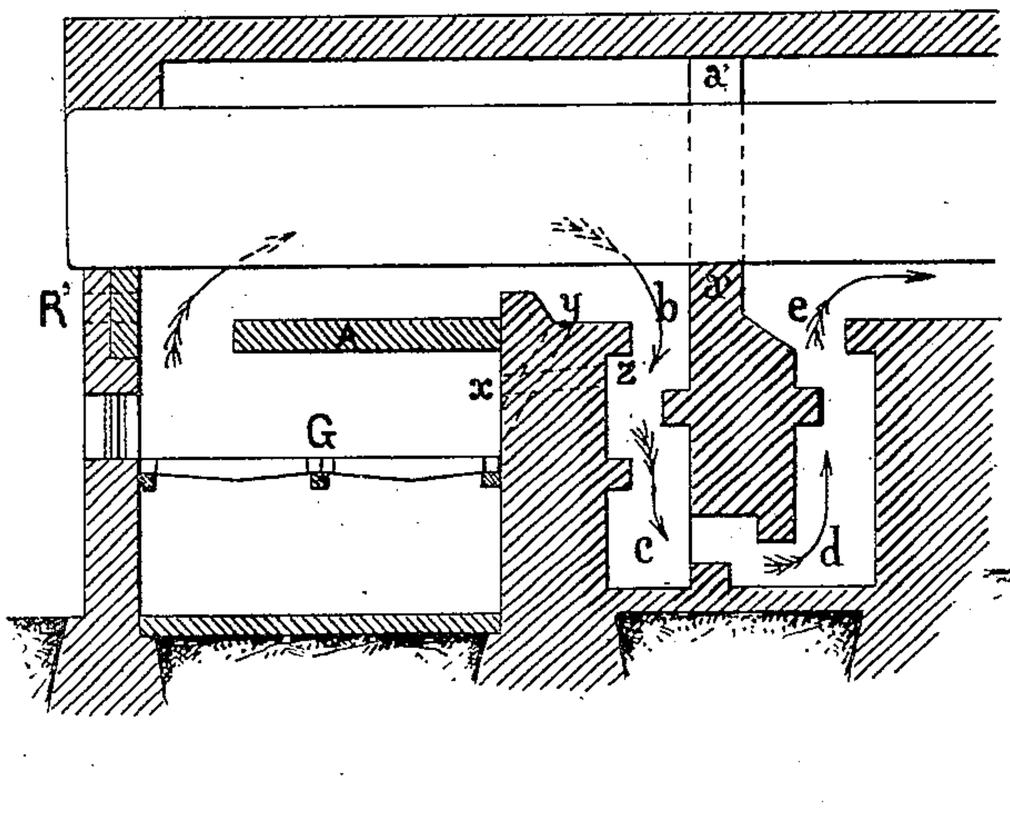
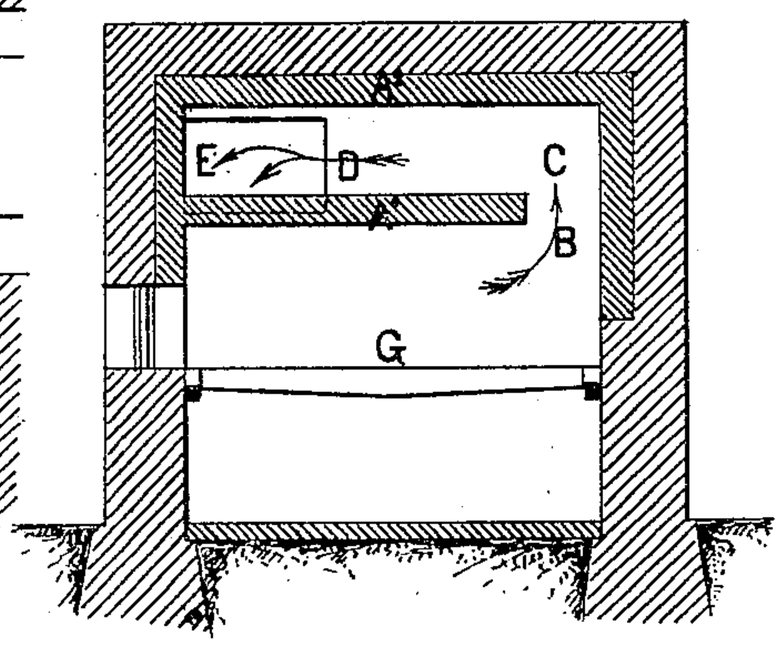


FIG. 11bis.

FIG. 10.





C. J. Hedrick
Philip Mellaire
Witnesses.

Georges Criner
by A. Pollok
his attorney.

UNITED STATES PATENT OFFICE.

GEORGES CRINER, OF PARIS, FRANCE.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 246,943, dated September 13, 1881.

Application filed June 1, 1881. (No model.) Patented in France April 12, 1879, and June 16, 1880, in Germany November 4, 1880, in Italy November 6, 1880, and in England November 19, 1880.

To all whom it may concern:

Be it known that I, GEORGES CRINER, of Paris, in the Republic of France, have invented a new and useful Improvement in Steam-Boiler and other Furnaces, which improvement is fully set forth in the following specification.

This invention has for its object to improve the combustion in boiler and other furnaces, so as to render them smoke-consuming and economical of fuel. To accomplish this result the highest possible temperature is produced in or near the fire-chamber, and the complete combustion of the gases from the fuel is secured by intimately mixing them with air in excess before they come into contact with the boiler or other apparatus, or with the material to be heated, and while they are still hot enough to insure that all combustible products are consumed. The grate is placed under an arch of refractory material, as has been done before in certain cases; but in the present invention this arch is provided with an outlet, by which the gases from the fire-chamber are conducted into a mixing-flue, also of refractory material, wherein they are thoroughly commingled and burned before being cooled by contact with the apparatus or material to be heated.

The burning-flue may be varied in form and arrangement.

The invention can be employed as well in modifying existing furnaces as in building new ones, the same means in principle being adopted in all cases, but the details being changed as circumstances may require or render it expedient.

The accompanying drawings, which form a part of this specification, illustrate furnaces constructed in accordance with the invention.

Figures 1, 1bis, 2, 3, 4, and 4bis represent different forms of boiler-furnaces in which the products of combustion pass over the boiler. Figs. 1, 2, 3, and 4 being longitudinal sections through the fire-chamber, and Figs. 1bis and 4bis transverse sections. Fig. 5 is a longitudinal section through the fire-chamber and boiler-furnace of a tubular boiler. The remaining figures represent other arrangements, Figs. 6, 7, 8, 9, 10, and 11bis being longitudinal sections; Figs. 6bis, 8bis, and 11 transverse sections, and Figs. 6ter, 7bis, and 11ter, horizontal sections.

A′ is an arch of refractory material, which forms a roof to the fire-chamber and aids in retaining the heat therein.

A^2 A^3 are additional arches; B C D E, the mixing or combustion flues; G, the fire-grate; H, a chamber to receive solid particles carried over in the draft; I, the steam-boiler; R R′, ports for inspection purposes. The ports R R′ are to be closed during the operation of the furnace by suitable doors, which are or may be provided with plates of glass or mica.

Referring to Figs. 1 and 1bis, the fire-chamber is made of sufficient depth to accommodate between the grate and boiler the two arches A′ A^2, which project from front and rear respectively, and overlap so as to form a tortuous-flue.

In Fig. 2 there is an additional arch, A^3, whereby the length and number of turns in the flue are increased.

The lower arch, A′, forms a roof to the fire-chamber, and projecting over the grate reflects or reverberates the heat back upon the fuel and aids in keeping it at a very high temperature, thus materially assisting combustion. After escaping from the fire-chamber the gases proceed through the tortuous burning-flue B C D E and become thoroughly mixed before reaching the boiler I.

The length of the flue can be increased without deepening the fire-chamber by forming said flue partly in one of the walls of the said chamber. In Fig. 3 it is formed partly in the rear wall, and in Figs. 4 and 4bis in one of the side walls.

To increase the useful effect of the apparatus obstructions may be placed in the mixing-flue, so that the gases are compelled to pass over or around them, and thus become thoroughly commingled, at the same time that they are kept longer in contact with the arch A′, forming the roof of the fire-chamber. These obstructions may be projections *a* from the arches A′ A^2 alternately, and extending entirely or partially across the flue, as shown in Fig. 5, or columns, as in Figs. 6 and 7, the columns be-

ing preferably arranged in rows, with the columns in one row opposite the spaces in adjacent rows.

The arrangement represented in Fig. 6 will be readily understood by reference to Figs. 6bis and 7ter, and that shown in Fig. 7 by reference to Fig. 7bis.

The chamber H (represented in Fig. 7) is designed to receive any cinders that may be carried out of the fire-chamber. It is closed by the valve R″.

The number, size, and disposition of the columns in the mixing-flue are varied according to the special circumstances of the case, those being adopted which are best adapted to the nature and quantity of fuel employed and the position which the furnace is to occupy. With very gaseous fuel the columns should be more numerous than when fuel that is less gaseous is used. If the arches A′ A² are close together the columns or obstructions should be placed a greater distance apart, so as to insure a sufficient space for the passage of the products of combustion. The examples already given will, however, suffice to indicate the manner in which the columns or obstructions are to be arranged.

It is not essential that the lower arch, A, should extend entirely over the fire, for if it does not the upper arch, A², will serve as a part of the roof and will aid in retaining the heat in the fire-chamber. It is sufficient that the lower arch should be extended so as to furnish a mixing-flue of suitable length; and in cases where it would be difficult to obtain the desired length of flue between the arches A′ and A² columns are also placed above the arch. This construction is represented in Figs. 8 and 8bis, wherein there are only two rows of columns between A′ and A² and four rows arranged, as shown in Fig. 7bis, above the arch A². When the grate cannot be lowered sufficiently to introduce two arches the flue is formed between the facing and the only arch that can be used.

Although the flue can be enlarged by increasing at this point the depth of the arch and providing it with obstructing-columns, the results are not very perfect, and can be improved by placing the columns over the arch, as before indicated, or by piercing the arch at various points to produce eddies in the current of the gas. In similar circumstances an auxiliary flue can be placed behind or at the side of the fire-place. In Fig. 10 a disposition of this kind is represented. The partition *a′*, made of any suitable refractory material, forces the products of combustion to pass through the auxiliary flue *b c d e*, the walls of which are provided with projections that obstruct the free passage of the said products. The partition may be fixed or movable, and fitted more or less tightly against the boiler. To insure their combustion from their entrance into the flue at *b*, holes are made through the back, as indicated at *x y z*, from suitable points above the grate, except where gas-yielding coals are to be used, and where it is not possible to lower the grate, in which case the arch can with less inconvenience be dispensed with.

For external fire-chambers in which the grate cannot be lowered, and in all kinds of internal fire-places, application is made of the invention by a use of the fire-chamber at the side or below the boiler. The disposition will, of course, vary according to circumstances, but in all cases the system herein indicated is employed, and the conditions best adapted to insure combustion are attained by the use of the arch of refractory material, and the flue, also of refractory material, not apt to cool the gases, and provided or not with columns or other obstructions.

In the furnace shown in Figs. 11, 11bis, and 11ter, the combustion-flue, which can be provided with obstructions to the flow of the gases, ends in the flue E, which may be horizontal, inclined, or curved, and of any desired length to deliver the products of combustion under the boiler, into a superheating-receptacle, or into any heating apparatus.

In Fig. 9 the fire-chamber is below the boiler, the flue B C D E is vertical, and delivers into the boiler-flues.

The grates in the boiler-flues, which are ordinarily employed in the type of boiler represented, are dispensed with.

The foregoing illustrations will, it is believed, sufficiently indicate the nature of the invention and the manner of applying the same in various circumstances.

It will be readily understood that in furnaces with large interior fire-chambers the invention can be applied with or without lowering the grate by an interior construction analogous to those represented in Figs. 1, 2, 5, 7, and 8, for example.

In the case of furnaces for steamboats and locomotives the principles hereinbefore explained are made use of. Sufficient space must, of course, be provided for the desired modification or addition.

The invention is not limited to boiler-furnaces for generating steam, but is applicable generally to all cases where a receptacle is to be heated in order to heat, melt, vaporize, or distill any substance whatever.

Having now fully described my said invention and the manner in which the same is or may be carried into effect, what I claim is—

1. The combination of a steam-boiler or similar receptacle, a fire-chamber, an arch spanning the said chamber, one or more additional arches, and a mixing or combustion flue formed wholly or partly in the furnace-walls and extending from the fire-chamber between the said arches to the steam-boiler or other receptacle, substantially as described.

2. The combination of two or more arches spanning the fire-chamber and arranged to

leave a flue between them and the columns or other obstructions in said flue, substantially as described.

3. The combination, with the fire-chamber and one or more arches spanning said chamber, of the columns or other obstructions above said arch or arches, substantially as described.

4. The combination, with a fire-chamber, arch spanning the same, and flue leading from the chamber, of an auxiliary flue forming a continuation of said flue and being with or without columns or other obstructions, said flue being arranged as explained, so that the products of combustion pass over the upper surface of the arch on their way to the auxiliary flue, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

G. CRINER.

Witnesses:
E. DE LAVIS,
G. DUPONT.